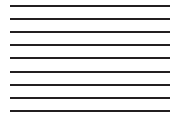




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## Education

### EMERGENCY MEDICINE RESIDENT ANESTHESIA TRAINING IN A PRIVATE VS. ACADEMIC SETTING

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**Abstract—Background:** Airway management is an essential part of any Emergency Medicine (EM) training program. Academic centers typically provide training to many learners at various training levels in a number of medical specialties during anesthesiology rotations. This potentially creates competition for intubation procedures that may negatively impact individual experiences. **Objectives:** We hypothesized that residents would report higher numbers of intubations and improved educational value in a private practice, rather than an academic, anesthesiology rotation. **Methods:** EM residents' anesthesiology training was evaluated pre and post a change in training setting from an academic institution to a private practice institution. **Outcome measures** included the number of self-reported intubations, resident ratings of the rotation, and the number of positive comments. **Residents' evaluation** was measured with: a 14-item evaluation; subjective comments, which two blinded reviewers rated as positive, negative, or neutral; and transcripts from structured interviews to identify themes related to training settings. **Results:** The number of intubations increased significantly in the private practice setting (4.6 intubations/day vs. 1.5 intubations/day,  $p < 0.001$ ). Resident evaluations improved significantly with the private practice experience (mean scores of 3.83 vs. 2.23,  $p$ -values  $< 0.05$ ). **Residents' impressions** were also significantly higher for the private practice setting with respect to increased educational value, greater use of adjunct airway devices, and directed teaching. **Conclusions:** Number of intubations

performed and residents' rating of the educational value were more favorable for a private practice anesthesiology rotation. Alternative settings may provide benefit for training in areas that have competition among trainees. © 2012 Elsevier Inc.

**Keywords—**anesthesiology; education; intubation; residency; airway management

### INTRODUCTION

Airway management is an essential part of Emergency Medicine (EM) residency training. The Residency Review Committee (RRC) requires that each resident complete a minimum of 35 intubations during residency (1). Some studies, however, have shown that as many as 76 intubations may be required for residents to achieve proficiency (2). It is important that residency programs provide an environment in which resident physicians may perform a substantial number of intubations.

Currently, the majority of Accreditation Council for Graduate Medical Education (ACGME)-accredited programs delivers training in academic medical centers, which provide anesthesiology training to a variety of learners besides EM residents. This creates significant competition for intubations that may negatively impact

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learners' experiences. Such competition may be minimized in an anesthesiology rotation in a private hospital setting.

Previous studies have evaluated the benefit of different educational interventions, but the effect of training setting has been evaluated in only one prior study, which measured the differences in procedural volume by rural vs. urban setting (3–5). Although the authors noted a significant difference in number of intubations at the rural vs. urban site (0 vs. 0.9 per 100 resident hours, respectively), this study included only a limited number of residents and intubation procedures.

The purpose of this study was to evaluate the number of intubations performed by EM residents during their anesthesiology rotation in a private practice hospital setting compared to an academic center. Additionally, the perceived educational value of each anesthesiology rotation was compared. Finally, overall themes about each practice setting through review of transcripts of semi-structured interviews conducted with residents were also compared. The working hypothesis was that residents completing their anesthesiology rotation in a private practice setting, rather than in an academic center, would report higher numbers of intubations and improved educational value of the rotation. We set out to disprove the null hypothesis that there was no difference in outcomes between the two centers.

## MATERIALS AND METHODS

To examine the current anesthesiology training settings used, we conducted an informal survey of residency directors through the Council of Emergency Medicine Residency Directors listserve in 2010. Approximately one-third of responding programs utilize private practice hospital settings for their anesthesiology training.

The study setting was an ACGME-accredited, 3-year EM residency based at an academic tertiary care center, 430-bed hospital, and Level I trauma center. In addition, residents rotate at a "private" Level I trauma center, which serves as a regional referral center for a network of community-based hospitals. The program matches eight residents per year; however, the class of 2009 had an additional resident, for a total of nine residents.

All post-graduate year 1 (PGY-1) EM residents undergo training in an anesthesiology rotation. The anesthesiology rotation was originally offered within the Department of Anesthesiology at the academic facility over a 3-week period. In addition to providing anesthesiology training to EM residents, the department provides education to a variety of other health care professionals.

The EM program changed the setting for the anesthesiology rotation in 2009 from the academic facility to

a private tertiary care center that did not have an anesthesiology residency program. The private center is a 428-bed hospital and is a major tertiary referral center for the region. This hospital has 25 operating rooms with anywhere from 75 to 115 cases scheduled daily. It is staffed by a private practice anesthesiology physician group, and there were only occasionally other trainees present.

The shift to a private practice center occurred at the beginning of the 2009–2010 academic year (July 2009). Further, under the assumption that the private setting would provide sufficient intubation experience in a 14-day period, the duration of the rotation was shortened from 3 to 2 weeks.

Eight PGY-1 residents, during the 2008–2009 academic year, were assigned to spend 3 weeks (range: 22–24 days) at the academic hospital. Their experience was compared to nine PGY-1 residents during the 2009–2010 academic year who were assigned to spend 14 days in the private hospital.

Resident participants self-reported their daily number of intubations using an on-line procedure log. Resident satisfaction was measured with a standardized 14-item evaluation used for resident rotation evaluation, comprising definitive statements about the rotation, which residents answered using a 1–4 rating scale (1-low, 4-high).

Residents were encouraged to provide subjective comments about the rotation. Residents had multiple opportunities to offer comments but were not required to make comments. There were 10 comments submitted in each cohort (some residents may have offered more than one comment and some residents may have offered none). Two blinded reviewers then independently reviewed the comments and assigned a positive, negative, or neutral value to the comment. The reviewers were blinded to the setting to which the comments pertained. The blinded reviewers were the associate program director and the administrative program coordinator of the EM residency. The review was conducted after all evaluations were completed and after Institutional Review Board approval.

After completion of both rotations, residents underwent standardized interviews with both fixed-response and open-ended questions with the residency directors to explore emergent themes relating to their experience. Interview transcripts were reviewed by the senior author to extract common themes.

Self-reported intubations, rotation evaluations, and subjective comments from residents were all gathered using the online residency management suite, New Innovations, Inc. (6). Results for the number of intubations per day in the academic and the private practice settings were analyzed using the Mann-Whitney test or the

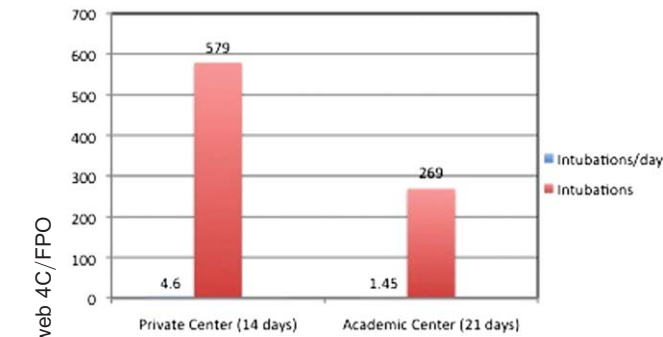


Figure 1. Intubations performed by site.

Student's *t*-test (SPSS; IBM, Armonk, NY). For resident satisfaction, averages for each practice setting, along with the SD, were recorded and the results were compared between the groups using Student's *t*-test. Comparison of the reviewer-encoded residents' comments between practice settings was performed using the chi-squared test. A two-sided probability value of  $p \leq 0.05$  was considered statistically significant. The study was approved by the Institutional Review Board.

## RESULTS

The number of intubations performed increased significantly in the private practice setting compared to the academic setting. Residents reported an average of  $4.60 \pm 0.77$  intubations per day in the private setting (median: 4.79 per day, range: 3.36–5.29 per day) compared to  $1.45 \pm 0.35$  per day in the academic setting (median:

1.34 per day, range: 1.13–2.13 per day,  $p < 0.001$ ) (Figure 1).

Resident ratings of the rotation improved significantly in the private setting in all areas measured. Residents reported a mean score of 3.83 for questions assessing their satisfaction and perceived educational experience in the private setting compared to a mean score of 2.23 for the academic setting ( $p$ -values for individual questions ranged from 0.0001 to 0.024) (Table 1).

The private setting rotation received a significantly higher number of positive comments from residents. Comments from the academic group showed only one positive comment out of 10, whereas all 10 comments about the private hospital experience were positive ( $p < 0.001$ ) (Figure 2).

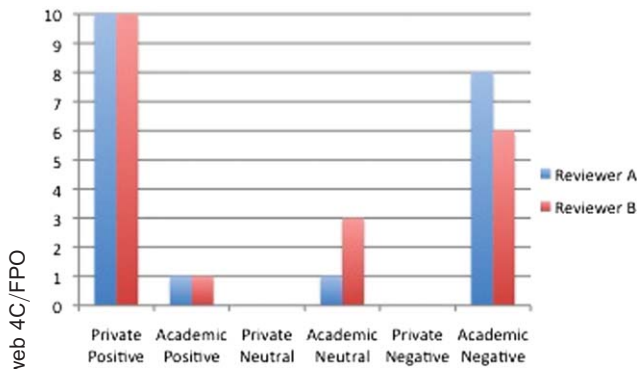
In reviewing resident interview transcripts, we noted strong agreement among rotators at the academic facility that the educational value and relevance to EM was moderate to low. Themes identified as contributing focused on 1) the outlook differences between specialties, 2) the lack of use of adjunct airway devices, 3) the low case volume, and 4) the large proportion of time spent providing intra-operative care without teaching. Rotators on the private rotation noted high educational value of the rotation with strong focus on EM. Factors contributing to their positive ratings included 1) large volume of intubations, 2) regular use of adjunct devices, and 3) teaching directed towards EM airway management. Areas of potential improvement included more focus on rapid sequence induction medications, difficult airway management, and ED care.

Table 1. Subjective Resident Assessment of Training Site

Question	Academic Ratings	Private Ratings	Difference	<i>p</i> -Value
#1 Rotation organization & content	1.8 (1–3)	3.8 (3–4)	+2	<0.0001
#2 A variety of patient problems representative of the discipline were seen	2 (1–3)	3.8 (3–4)	+1.8	<0.0001
#3 The rotation was well organized with an efficient use of my time	1.8 (1–4)	3.8 (3–4)	+2	0.0002
#4 There were sufficient opportunities for me to participate in patient care and management	2.1 (1–3)	3.9 (3–4)	+1.8	<0.0001
#5 This rotation has relevance to my goals and future clinical practice	2.6 (2–3)	3.8 (3–4)	+1.2	0.0003
#6 I was given responsibilities & work duties equivalent to other residents (of any specialty) in the same year of training on the rotation	2 (1–3)	3.8 (3–4)	+1.8	<0.0001
#7 The educational benefit justified the amount of work performed	2.1 (1–3)	3.9 (3–4)	+1.8	<0.0001
#8 Duty hour regulations were monitored and adhered to throughout the rotation	3.1 (2–4)	3.9 (3–4)	+0.8	0.024
#9 This rotation is valuable in developing clinical judgment	2.1 (1–3)	3.8 (3–4)	+1.7	<0.0001
#10 This rotation is valuable in developing my procedural skills	2.8 (2–4)	4 (4)	+1.2	*
#11 This rotation is valuable in developing and practicing patient management skills	2 (2)	3.4 (2–4)	+1.4	*
#12 My participation in clinical decision-making was valued by the faculty and other residents on this rotation	1.8 (1–2)	3.6 (3–4)	+1.8	<0.0001
#13 The faculty and residents on this rotation treated me in a professional manner and with respect throughout the rotation	2.3 (1–3)	3.9 (3–4)	+1.6	0.0001
#14 The overall value of this rotation toward educating Emergency Medicine residents is ____	2.1 (1–3)	4 (4)	+1.9	*
Total	2.2 (1–4)	3.8 (2–4)	+1.6	N/A

\* These survey questions yielded a SD of 0 for one of the two groups. *p*-Value for these questions could not be calculated.





**Figure 2. Subjective assessment of resident comments on training sites.**

## DISCUSSION

EM resident intubations in North America are performed with high success, which improves with each year of resident training (7). Our study has evaluated the effect of educational setting on basic airway management experience.

The number of intubations performed by EM residents while completing an anesthesiology rotation was significantly higher when that rotation was performed in a private practice setting, compared to an academic setting. Likewise, residents' rating of the educational value of the rotation was more favorable for the private practice setting.

These results suggest that a private practice environment, in which there are fewer learners competing for procedures, may provide a more efficient educational experience. In addition to the purely mechanical skill of intubation, we evaluated the conveyance of cognitive and non-mechanical, didactic information. Interestingly, the self-reported resident satisfaction with the educational value of the experience uniformly favored the private practice setting for this single-site study.

Depending on the situation at individual academic institutions, some residency training sites may wish to seek cooperation with regional private hospitals and pursue more non-academic training sites for procedure-intensive rotations. This is especially true for residency programs that are not achieving sufficient procedural training at their home institutions. Such partnerships may actually provide greater training efficiency, thus decreasing the rotation duration necessary to achieve competency. Our results suggest that further studies involving additional residency programs, and evaluating these findings with other rotations for which the RRC requires multiple procedures (i.e., Obstetrics and Orthopedics), may be worth pursuing.

Some may argue that alternative training methods exist which do not require experiences with intubation in human patients. Whereas only one prior study has evalu-

ated the effect of training setting, several previous studies highlighted the use of simulation in airway management training (5). The utility of simulators for endotracheal intubation training has been evaluated from as early as 1973 and has consistently produced encouraging results regarding its use (8–10). The use of simulation in airway training has been widely used and may enhance the skill of the individual while reducing the risk to the patient (11–19).

However, whereas one study suggested that simulator effectiveness is equivalent to actual patient intubation, contemporary methods may lack the authenticity of a living human being (9,20). The complex nature of reproducing the variability of anatomic structures, reciprocal forces, and clinical scenarios that can occur during actual patient intubations stands as a barrier to the widespread use of simulator training models as a replacement for experience. While simulation and mannequin-based training alternatives become increasingly more life-like, the gold standard for airway management training remains the intubation of human patients. Thus, we believe that current research evaluating the most productive training methods will continue to evaluate overall intubation success rates of actual patients as the primary outcomes. This view is supported by the RRC requirement for residency proficiency demonstrated through intubations performed on patients.

## Limitations

The design of this study did not allow for participant randomization, introducing the possibility of systematic bias caused by differences in class demographics. Furthermore, there may be bias inherent in the timing of our study, as this was the first time a change of this nature took place within the residency. Subsequent years may not yield similar results. In addition, our outcomes are not a true evaluation of proficiency, but a surrogate. Further studies using video assessment of intubations or simulated intubations would be a better way to truly evaluate proficiency. We did not look at the use of adjunct airway devices as a primary outcome and this could also be evaluated with future studies. Finally, this study represents an assessment of a single residency program with a small sample size utilizing only one facility of each type, limiting its generalizability. Further studies performed at a variety of centers with a larger sample size would be necessary to validate these results and should be performed.

## CONCLUSIONS

EM residents completing an anesthesiology rotation reported an increased number of intubations, improved

satisfaction, and an overall increase in positive comments in a private practice setting compared to an academic setting. Alternative practice settings, specifically a private practice environment, may provide benefit for resident education in training areas that have competition among trainees.

# SUPPLEMENTARY DATA

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.jemermed.2012.08.031>.

# REFERENCES

1. Accreditation Council for Graduate Medical Education. Emergency medicine guidelines. Available at: [http://www.acgme.org/acWebsite/RRC\\_110/110\\_guidelines.asp](http://www.acgme.org/acWebsite/RRC_110/110_guidelines.asp). Accessed April 30, 2011.
2. de Oliveira Filho GR. The construction of learning curves for basic skills in anesthetic procedures: an application for the cumulative sum method. *Anesth Analg* 2002;95:411–6.
3. Wang EE, Quinones J, Fitch MT, et al. Developing technical expertise in emergency medicine: the role of simulation in procedural skill acquisition. *Acad Emerg Med* 2008;15:1046–57.
4. Kovacs G, Bullock G, Ackroyd-Stolarz S, et al. A randomized controlled trial on the effect of educational interventions in promoting airway management skill maintenance. *Ann Emerg Med* 2006;36:301–9.
5. Wadman MC, Fago B, Hoffman LH, et al. A comparison of emergency medicine resident clinical experience in a rural versus urban emergency department. *Rural Remote Health* 2010;10:1442.
6. New Innovations, Inc. New Innovations Website. Available at: <http://www.new-innov.com/pub/rms/main.aspx>. Accessed April 30, 2011.
7. Sagarin MJ, Barton ED, Chng YM, Walls RM, National Emergency Airway Registry Investigators. Airway management by US and Canadian emergency medicine residents: a multicenter analysis of more than 6,000 endotracheal intubation attempts. *Ann Emerg Med* 2005;46:328–36.
8. Howells TH, Emery FM, Twentyman JEC. Endotracheal intubation training using a simulator: an evaluation of the Laerdal adult intubation model in the teaching of endotracheal intubation. *Br J Anaesth* 1973;45:400–2.
9. Gaba DM, DeAnda A. A comprehensive anesthesia simulation environment: recreating the operating room for research and training. *Anesthesiology* 1988;69:387–94.
10. Ten Eyck RP. Simulation in emergency medicine training. *Pediatr Emerg Care* 2011;27:333–41.
11. Mayrose J, Kesavadas T, Chugh K, et al. Utilization of virtual reality for endotracheal intubation training. *Resuscitation* 2003;59:133–8.
12. Chopra V, Gesink BJ, De Jong J, et al. Does training on an anaesthesia simulator lead to improvement in performance? *Br J Anaesth* 1994;73:293–7.
13. Boedeker BH, Boedeker KA, Bernhagen MA, et al. Battlefield tracheal intubation training using virtual simulation: a multi center operational assessment of video laryngoscope technology. *Stud Health Technol Inform* 2011;163:74–6.
14. McLaughlin SA, Bond W, Promes S, et al. The status of human simulation training in emergency medicine residency programs. *Simul Healthc* 2006;1:18–21.
15. Okuda Y, Bond W, Bonfante G, et al. National growth in simulation training within emergency medicine residency programs. *Acad Emerg Med* 2008;15:1113–6.
16. Binstadt E, Donner S, Nelson J, et al. Simulator training improves fiber-optic intubation proficiency among emergency medicine residents. *Acad Emerg Med* 2008;15:1211–4.
17. Nishisaki A, Nguyen J, Colborn S, et al. Evaluation of multidisciplinary simulation training on clinical performance and team behavior during tracheal intubation procedures in a pediatric intensive care unit. *Pediatr Crit Care Med* 2011;12:406–14.
18. Overly FL, Sudikoff SN, Shapiro MJ. High fidelity medical simulation as an assessment tool for pediatric residents' airway management skills. *Pediatr Emerg Care* 2007;23:11–5.
19. Mayo PH, Hackney JE, Mueck J, et al. Achieving house staff competence in emergency airway management: results of a teaching program using computerized patient simulator. *Crit Care Med* 2004;32:2422–7.
20. Hall RE, Plant JR, Bands CJ, et al. Human patient simulation is effective for teaching paramedic students endotracheal intubation. *Acad Emerg Med* 2005;12:850–5.

## ARTICLE SUMMARY

### 1. Why is this topic important?

This is an important topic because it is relevant to every trainee and educator in Emergency Medicine. Airway management is one of the essential skills that we need to learn and teach, and there have been few studies that specifically address the proper setting to teach these skills.

### 2. What does this study attempt to show?

This study attempts to show that an alternative practice setting, in this case a private practice setting for an Emergency Medicine resident Anesthesiology rotation, can increase the educational value for procedurally based rotations.

### 3. What are the key findings?

The key findings are an increase in number of intubations and residents' perceived educational value of an Anesthesiology rotation when performed in a private practice setting, as compared to an academic setting.


### 4. How is patient care impacted?

Patient care may be impacted by the increased skill and confidence gained by resident trainees during intubations that they perform in the Emergency Department after learning in a potentially more educationally robust setting such as the private practice setting described.

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